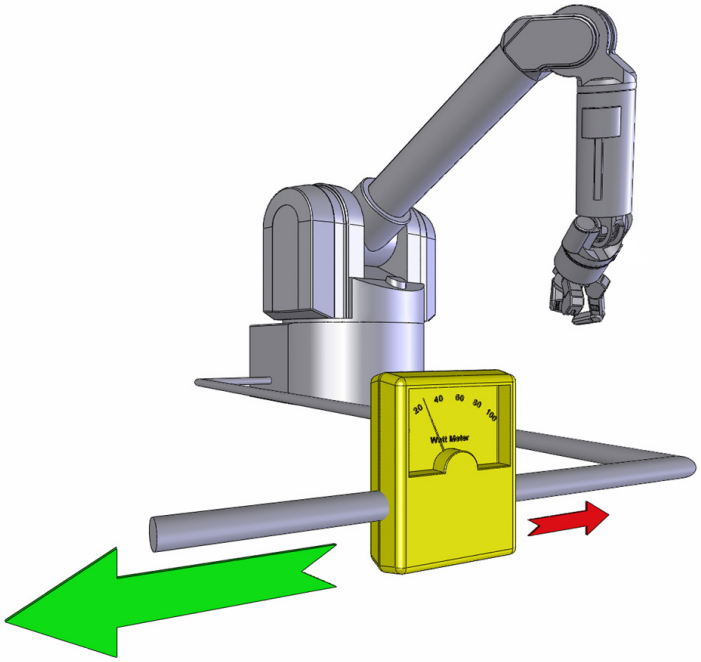
Two Safety Solutions Specific to Service Manipulators

Robot safety has been important in factories for decades. Indeed, many factory workers have been killed, primarily by crushing. A fencing strategy has evolved as the primary safety measure. However, the whole notion of service robots undercuts this primary line of defense. Secondary measures, such as velocity limiting, torque limiting, heartbeat sensing, etc., while all essential safety measures, are either insufficient or (in the case of E-Stop braking) potentially dangerous.

Barrett's newest WAM (whole-arm manipulator) arm introduces two safety measures developed specifically for service robotics:

1. Strictly limit total electric system power to well below human (mechanical-power-output) levels by virtual elimination of power inefficiencies.

2. Match the special combination of open-loop backdrivability (low backdriven friction and low backdriven inertia) with kinematic redundancy, thereby divorcing structural pose from Hand operations.



Both concepts will be demonstrated with a full sized (1-m reach, 3-kg payload), active 4-dof WAM robotic arm that operates with only 30 Watts (equivalent to 26 food-calories per hour) (red arrow). Indeed, unlike humans, power flow will be shown to reverse (green arrow) with mild human interaction. Also, a back-and-forth Cartesian hand path will be followed persistently while the arm structure responds continuously to unpredictable human and obstacle disturbances.

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